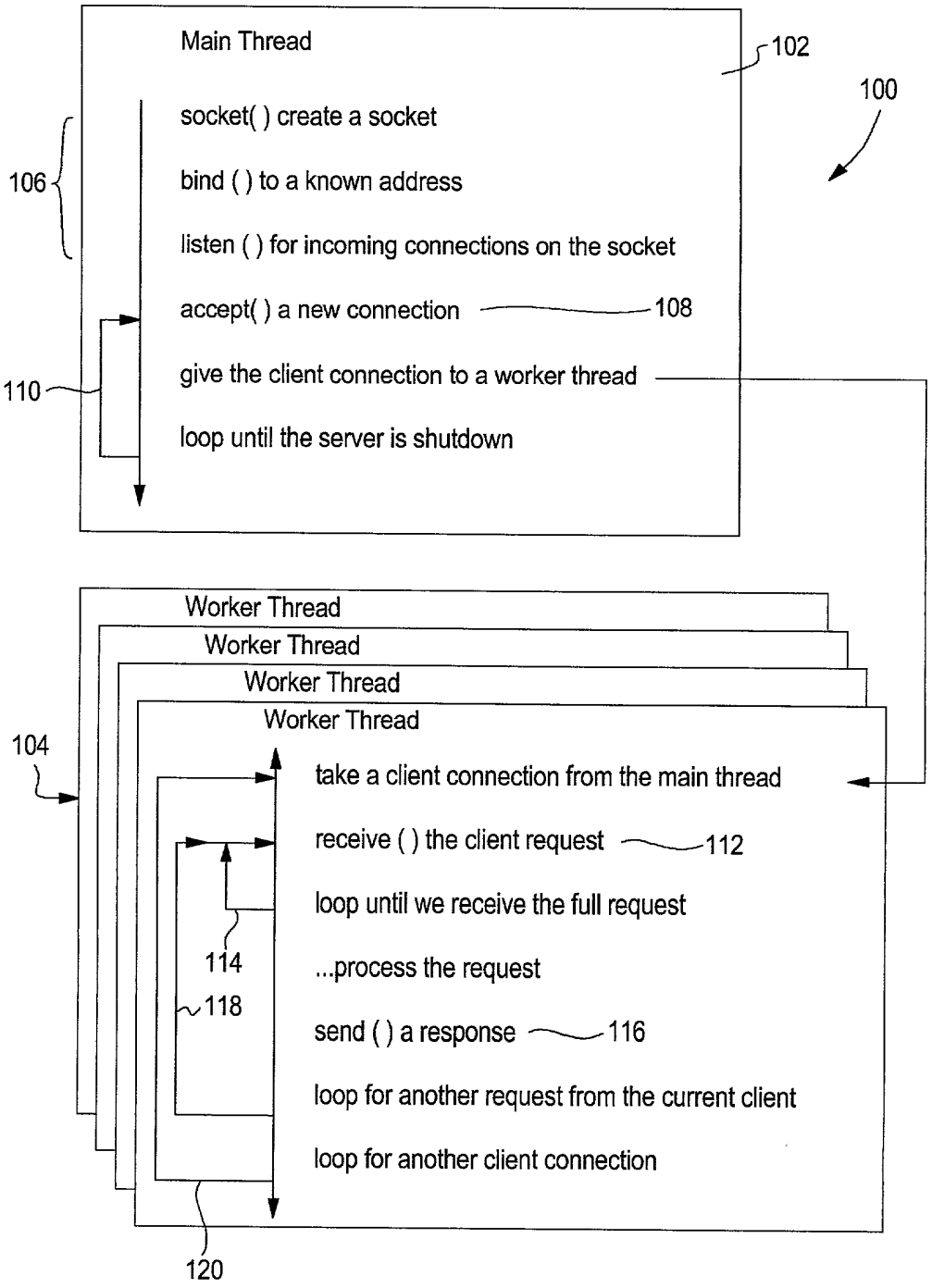

FIG. 1
Prior Art

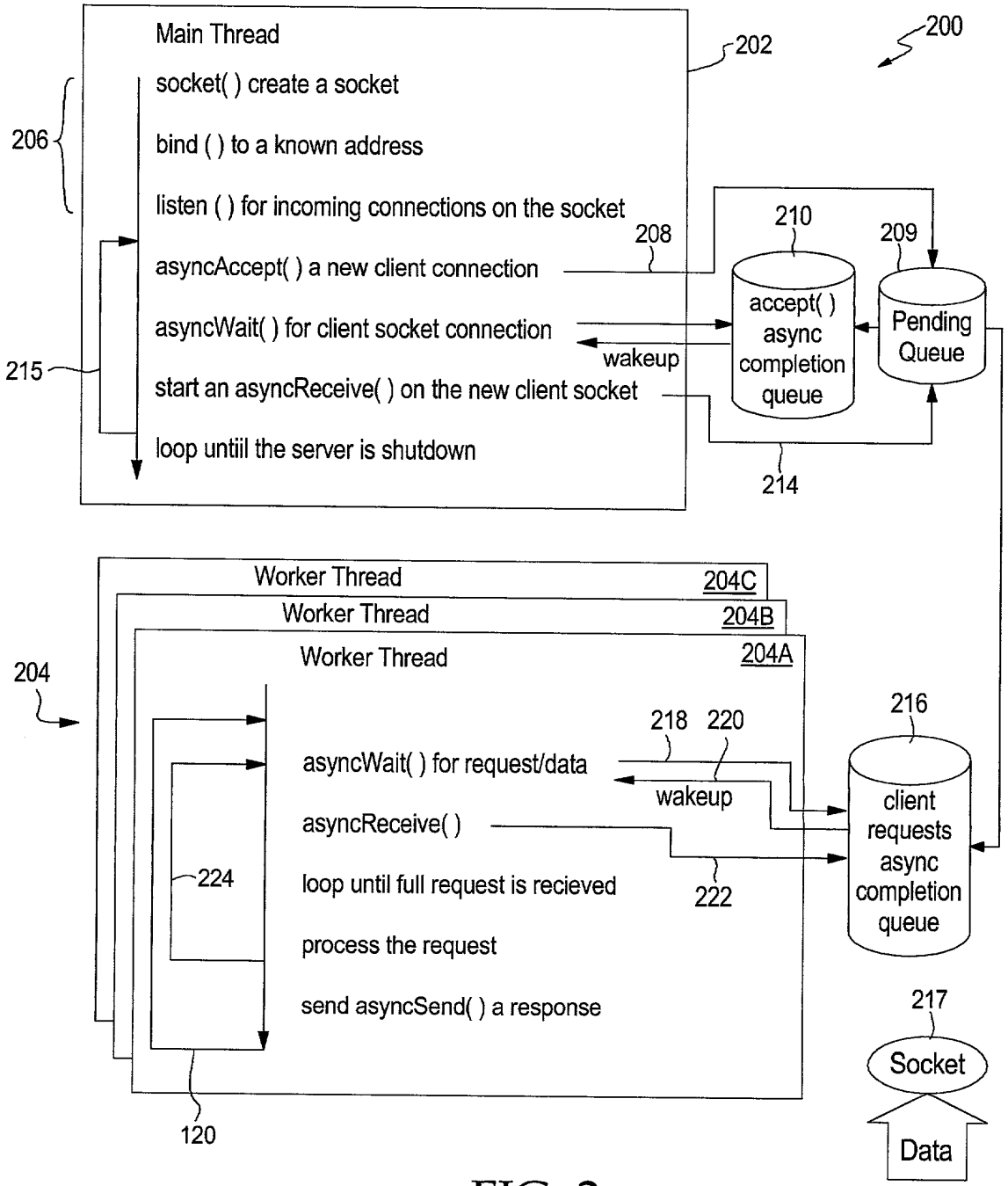

FIG. 2
Prior Art

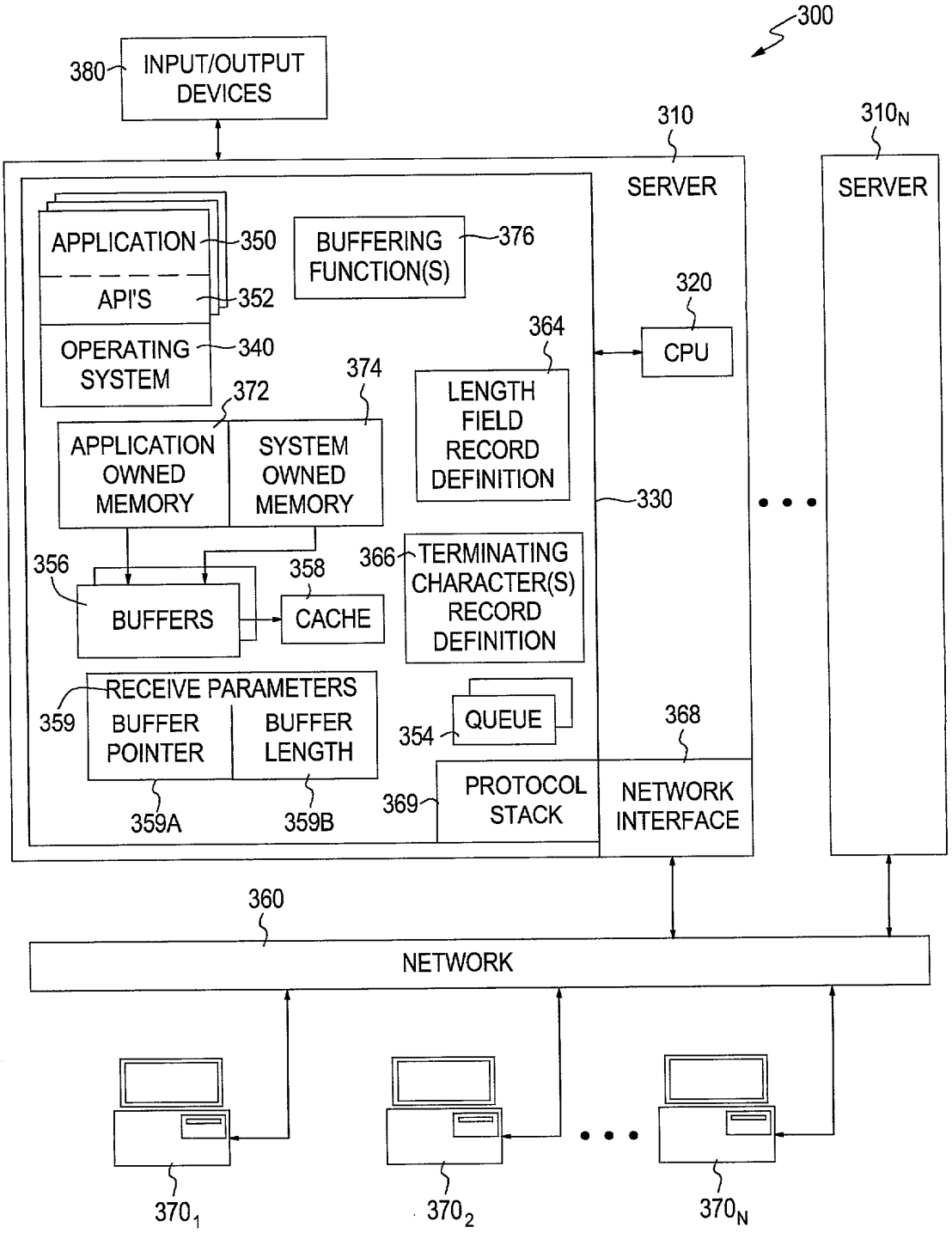
300
380
INPUT/OUTPUT DEVICES
310
SERVER
310N
SERVER
APPLICATION
350
API'S
352
OPERATING SYSTEM
340
BUFFERING FUNCTION(S)
376
320
CPU
364
LENGTH FIELD RECORD DEFINITION
374
372
APPLICATION OWNED MEMORY
SYSTEM OWNED MEMORY
330
356
BUFFERS
358
CACHE
366
TERMINATING CHARACTER(S) RECORD DEFINITION
359
RECEIVE PARAMETERS
BUFFER POINTER
BUFFER LENGTH
359A
359B
354
QUEUE
368
369
PROTOCOL STACK
NETWORK INTERFACE
360
NETWORK
370₁
370₂
370N

FIG. 3

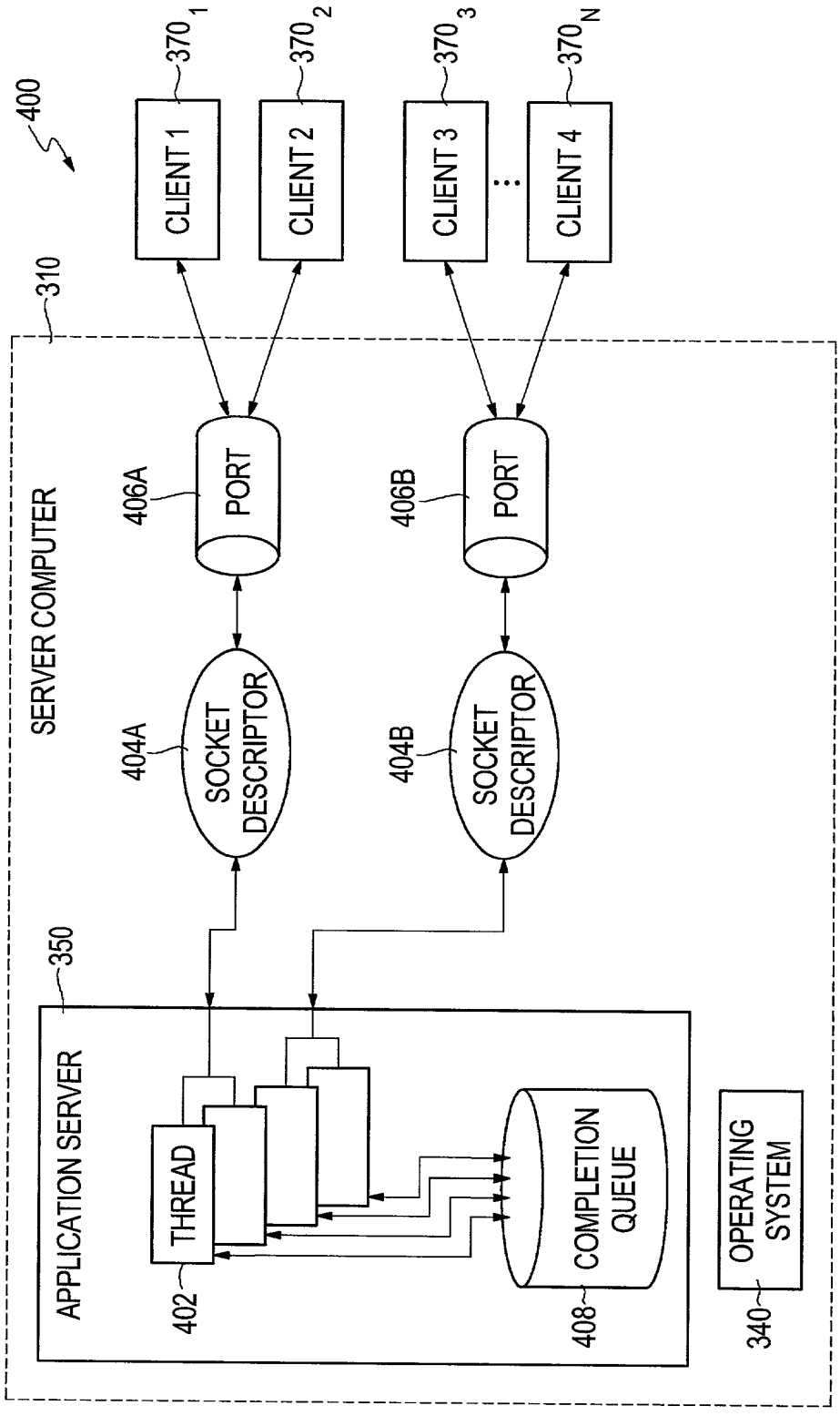
400
CLIENT 1
CLIENT 2
CLIENT 3
CLIENT 4
370 1
370 2
370 3
370 N
310
SERVER COMPUTER
406A
PORT
406B
PORT
404A
SOCKET DESCRIPTOR
404B
SOCKET DESCRIPTOR
350
APPLICATION SERVER
THREAD
402
COMPLETION QUEUE
408
OPERATING SYSTEM
340

FIG. 4

5/14

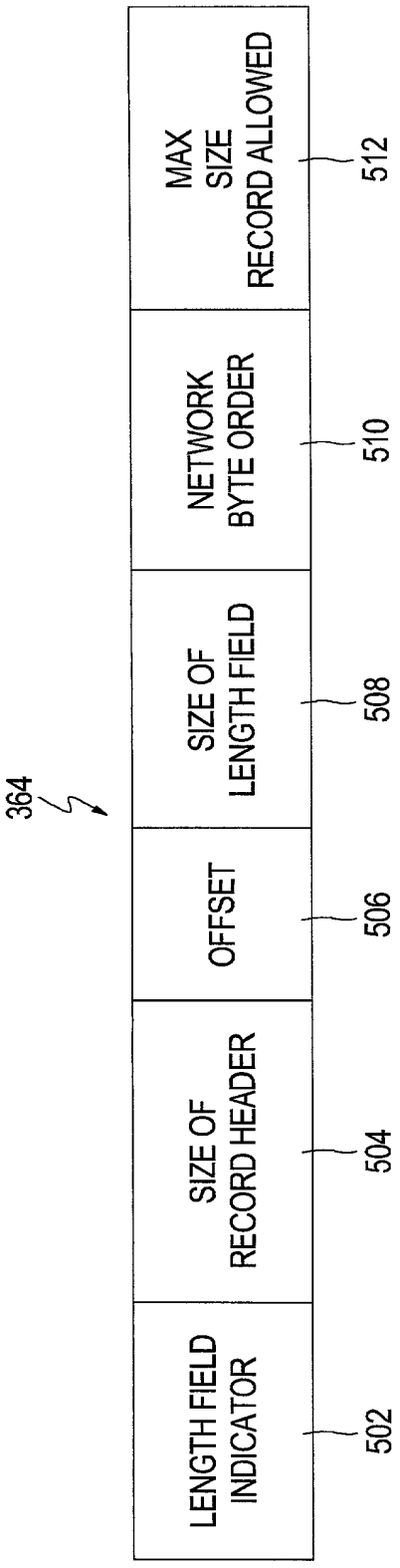

FIG. 5

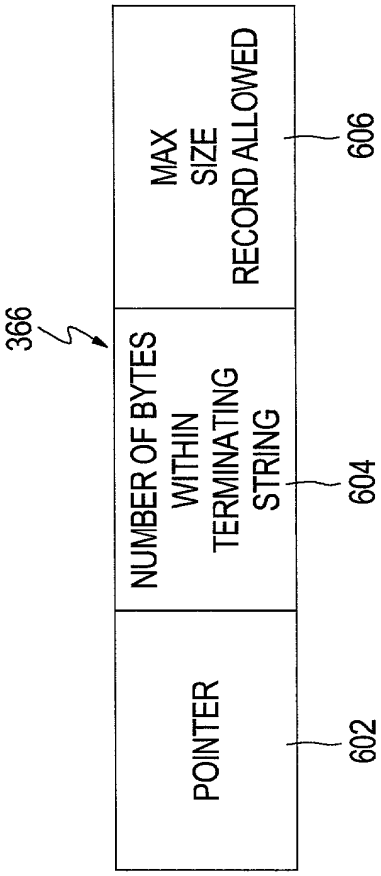

FIG. 6

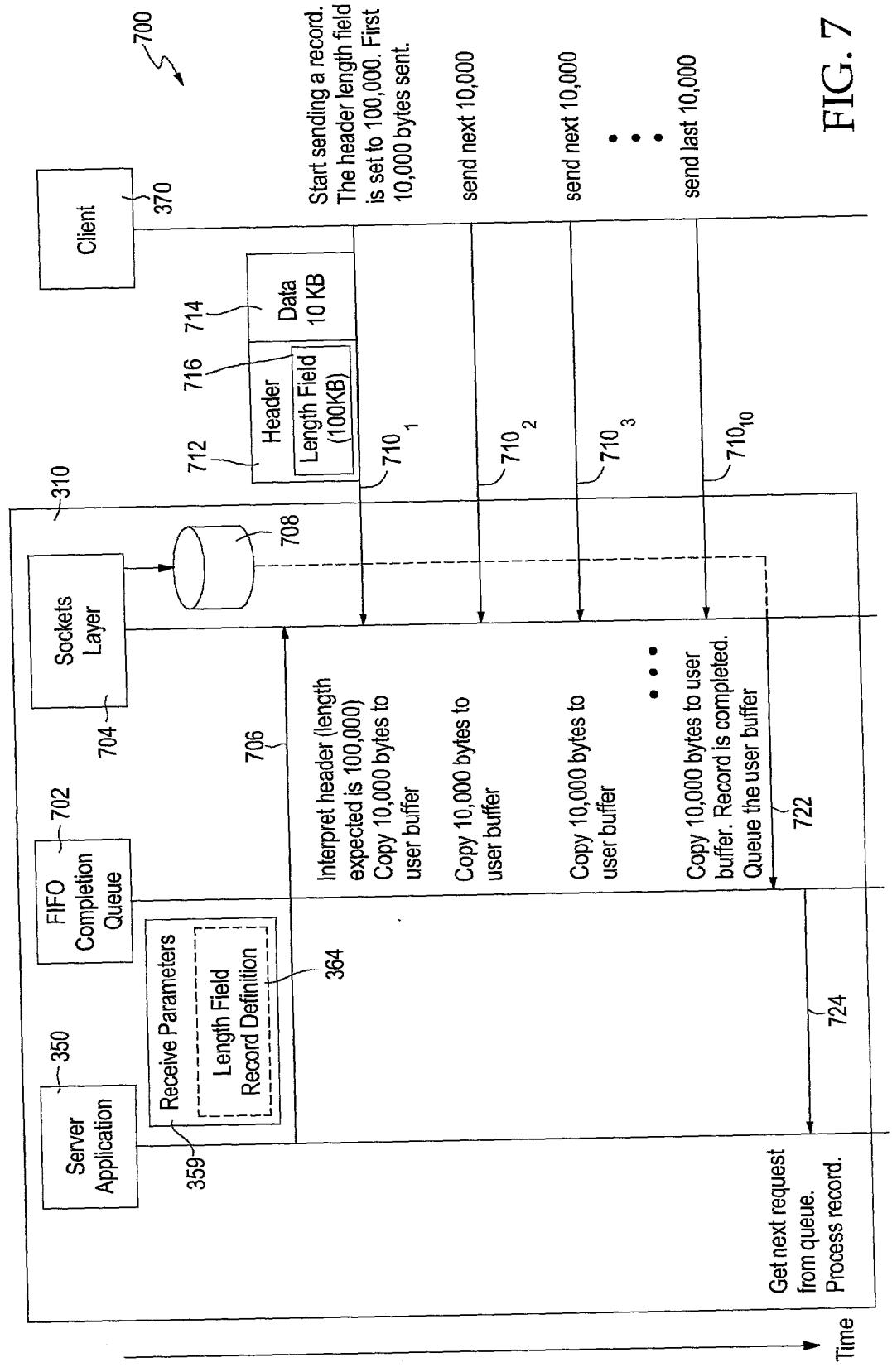
700
Client
370
Start sending a record. The header length field is set to 100,000. First 10,000 bytes sent.
send next 10,000
send next 10,000
send last 10,000
714
Data 10 KB
716
Header
Length Field (100KB)
712
710_1
710_2
710_3
710_{10}
310
Sockets Layer
704
708
706
Interpret header (length expected is 100,000) Copy 10,000 bytes to user buffer
Copy 10,000 bytes to user buffer
Copy 10,000 bytes to user buffer
Copy 10,000 bytes to user buffer. Record is completed. Queue the user buffer
722
724
FIFO Completion Queue
702
Receive Parameters
Length Field Record Definition
364
359
Server Application
350
Get next request from queue. Process record.
Time

FIG. 7

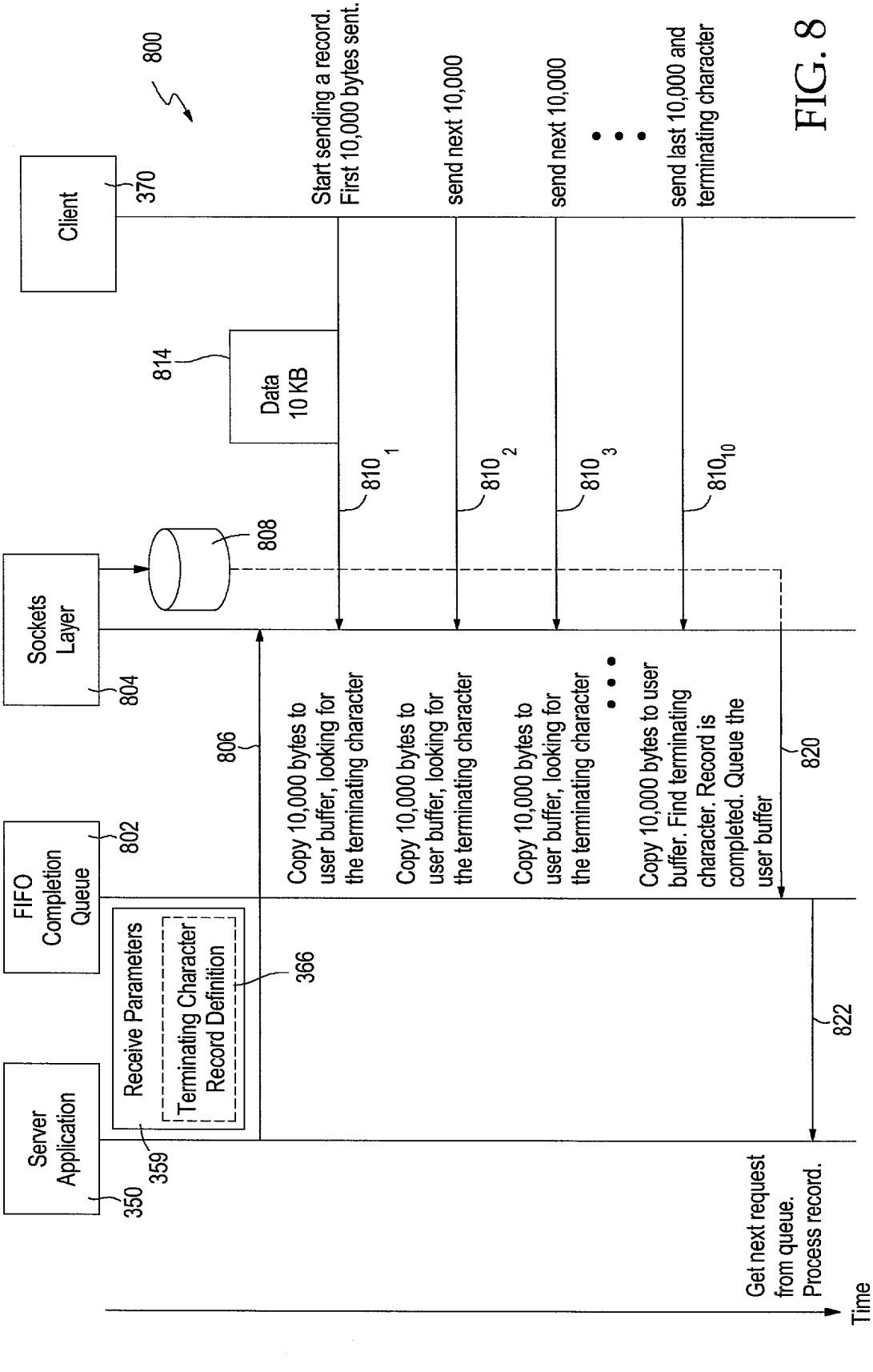
800
Client
370
Start sending a record. First 10,000 bytes sent.
send next 10,000
send next 10,000
send last 10,000 and terminating character
814
Data 10 KB
810_1
810_2
810_3
810_{10}
808
Sockets Layer
804
806
Copy 10,000 bytes to user buffer, looking for the terminating character
Copy 10,000 bytes to user buffer, looking for the terminating character
Copy 10,000 bytes to user buffer, looking for the terminating character
Copy 10,000 bytes to user buffer. Find terminating character. Record is completed. Queue the user buffer
820
FIFO Completion Queue
802
Receive Parameters
Terminating Character Record Definition
366
822
Server Application
350
359
Get next request from queue. Process record.
Time

FIG. 8

8/14

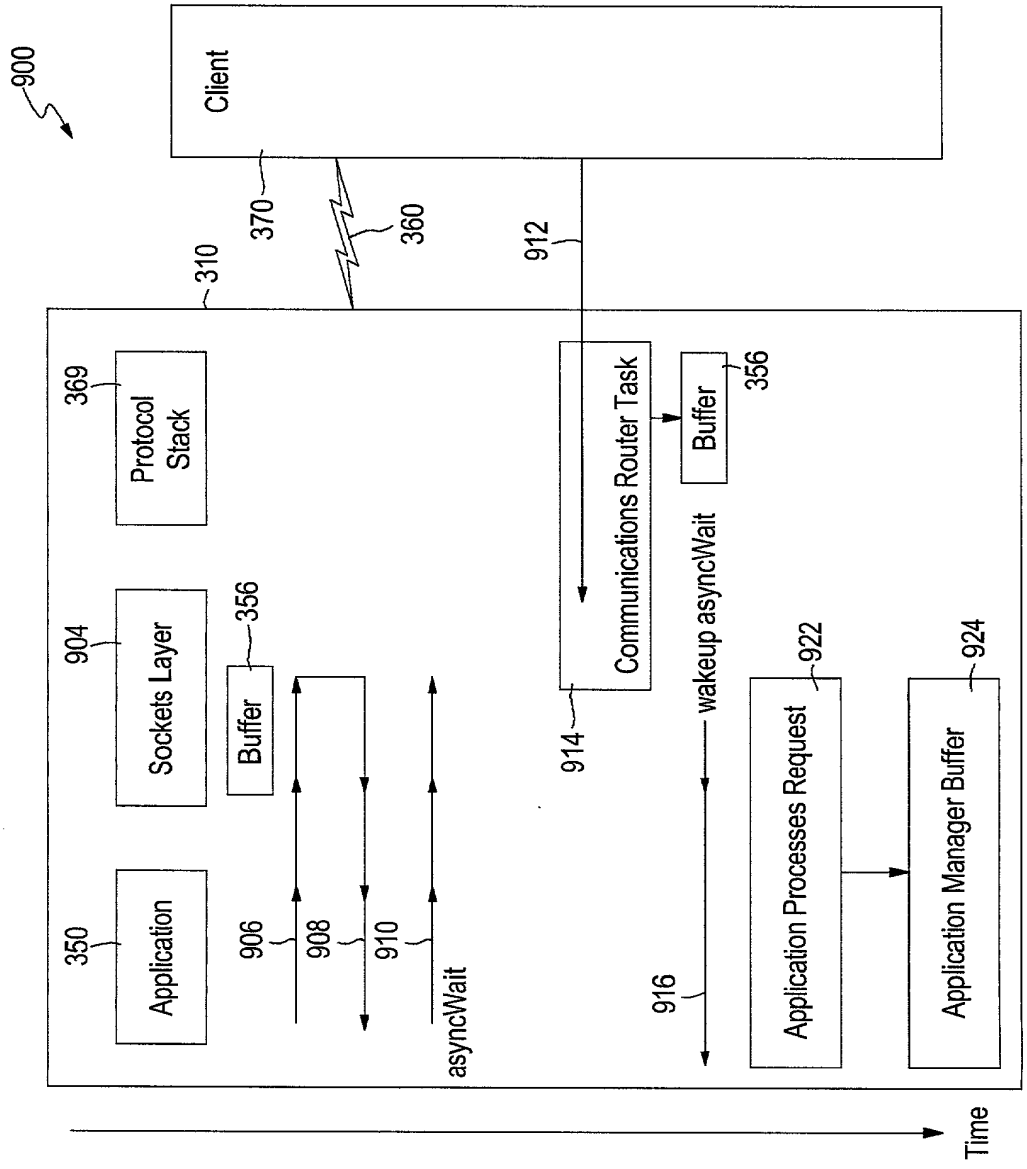
900
Client
370
360
912
310
369
Protocol Stack
904
Sockets Layer
356
Buffer
350
Application
906
908
910
asyncWait
914
Communications Router Task
Buffer
356
wakeup asyncWait
916
922
Application Processes Request
924
Application Manager Buffer
Time

FIG. 9

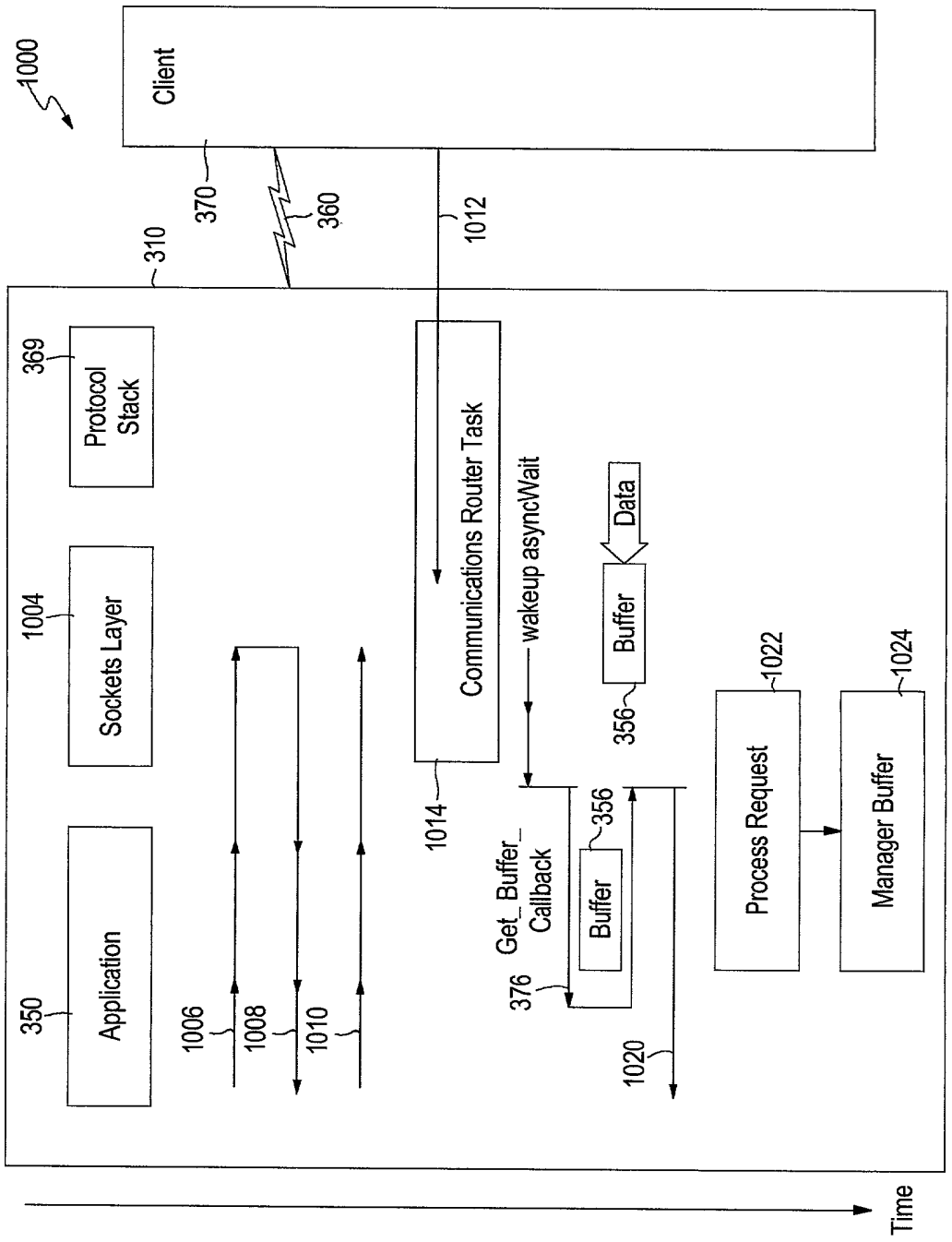
1000
Client
370
360
1012
310
369
Protocol Stack
1004
Sockets Layer
350
Application
1006
1008
1010
Communications Router Task
1014
wakeup asyncWait
Get_ Buffer_ Callback
376
Buffer
356
Data
Buffer
356
1020
Process Request
1022
Manager Buffer
1024
Time

FIG. 10

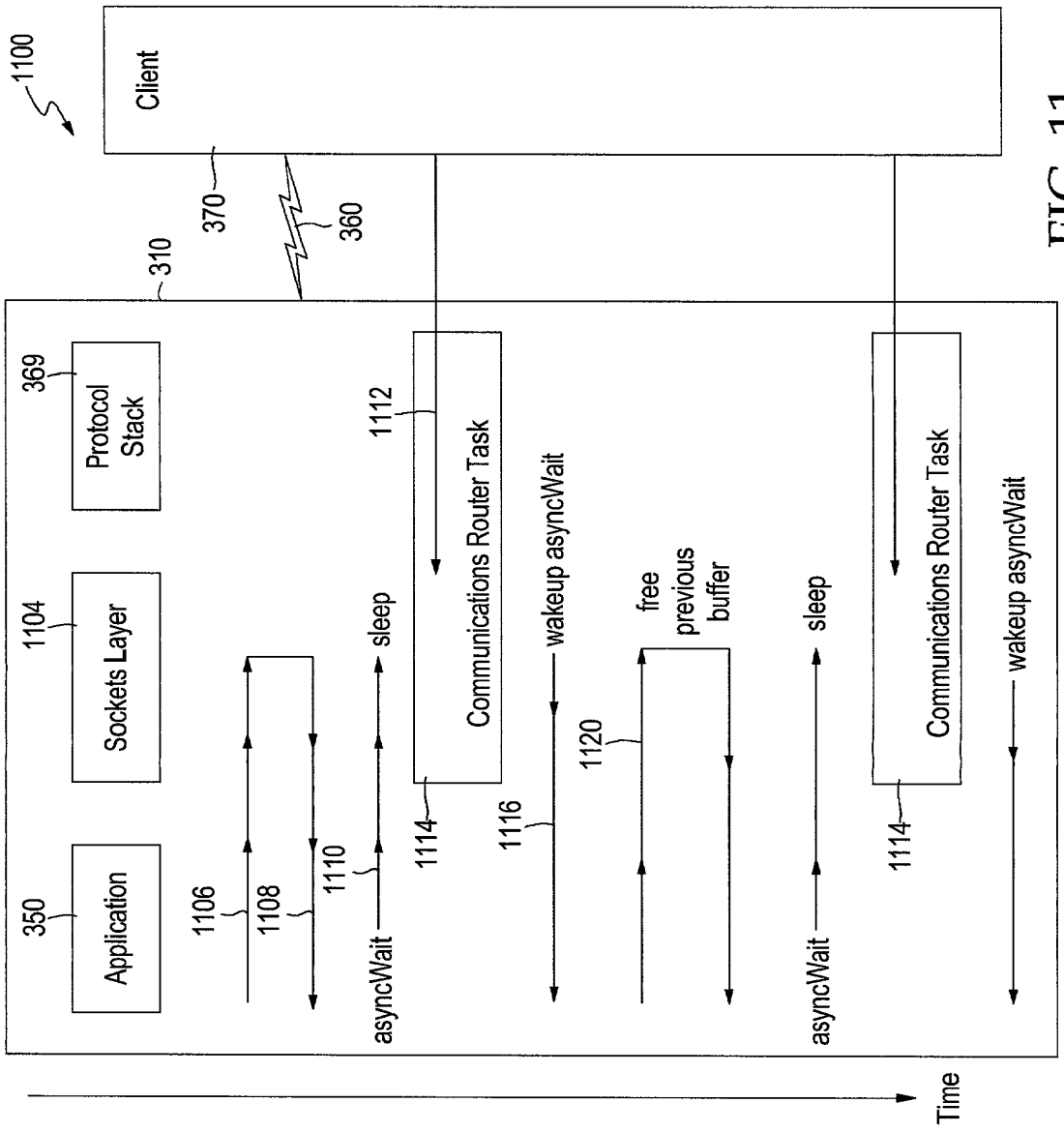
1100
Client
370
360
310
369
Protocol Stack
1104
Sockets Layer
350
Application
1106
1108
1110
asyncWait
sleep
1112
Communications Router Task
1114
1116
wakeup asyncWait
1120
free previous buffer
asyncWait
sleep
1114
Communications Router Task
wakeup asyncWait
Time

FIG. 11

11/14

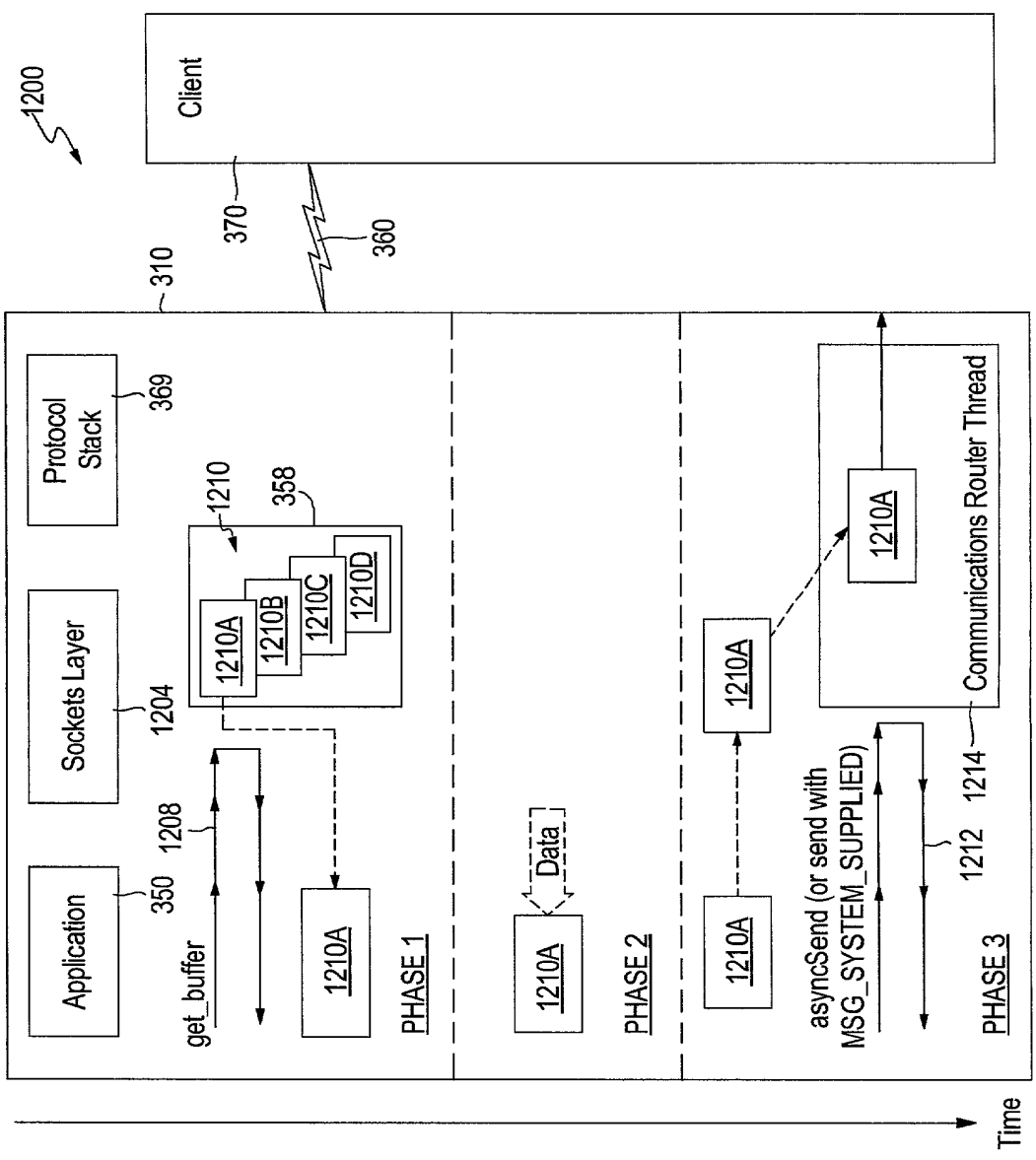
1200
Client
370
360
310
Protocol Stack
369
Sockets Layer
1204
1210
358
1210A
1210B
1210C
1210D
Application
350
1208
get_buffer
1210A
PHASE 1
1210A
Data
PHASE 2
1210A
1210A
Communications Router Thread
asyncSend (or send with MSG_SYSTEM_SUPPLIED)
1212
1214
PHASE 3
Time

FIG. 12

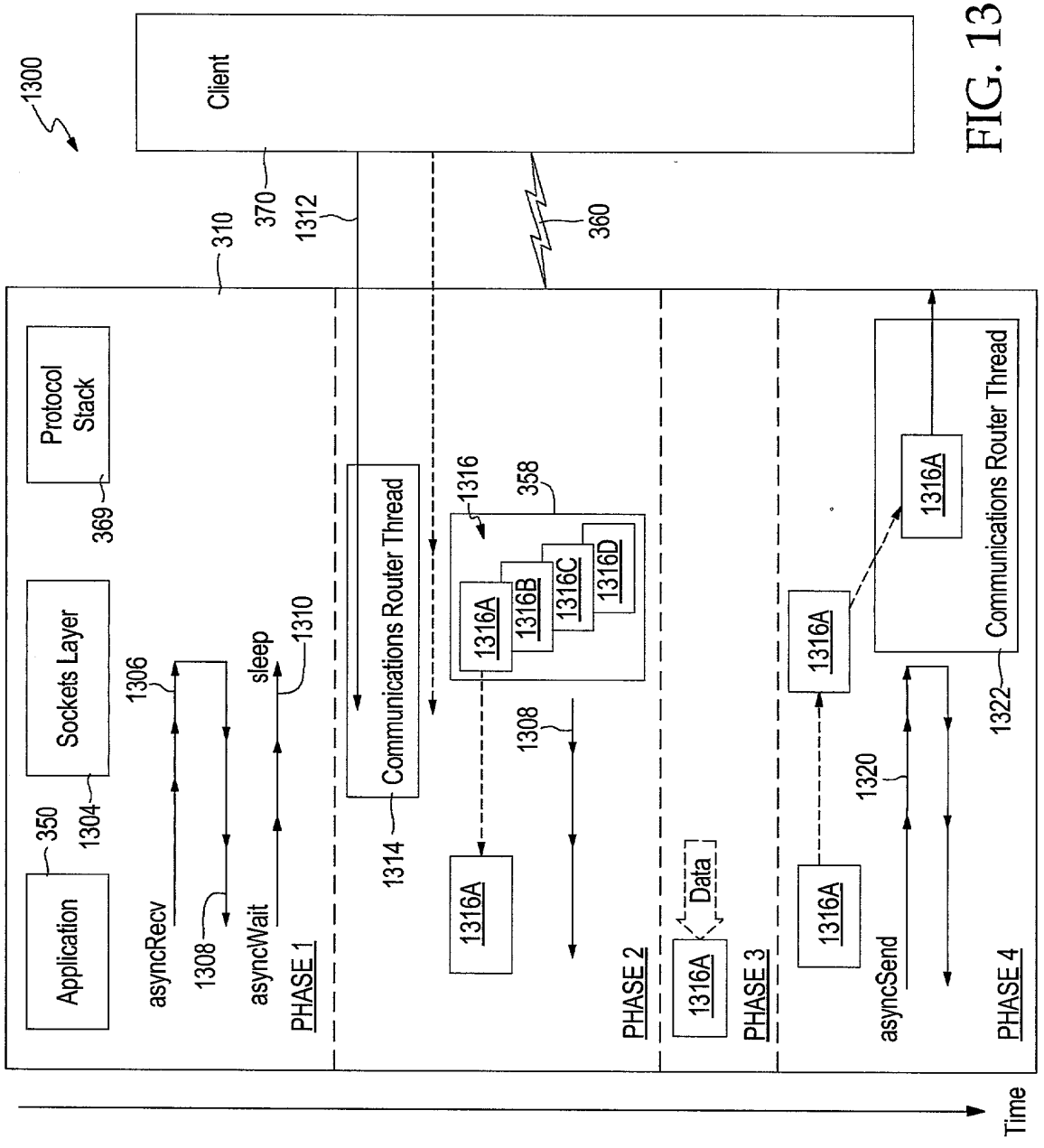
1300
Client
310
370
1312
360
Application
350
Sockets Layer
1304
Protocol Stack
369
asyncRecv
1306
1308
asyncWait
sleep
1310
PHASE 1
Communications Router Thread
1314
1316
358
1316A
1316B
1316C
1316D
1316A
1308
PHASE 2
1316A
Data
PHASE 3
1316A
1316A
asyncSend
1320
Communications Router Thread
1322
PHASE 4
Time

FIG. 13

13/14

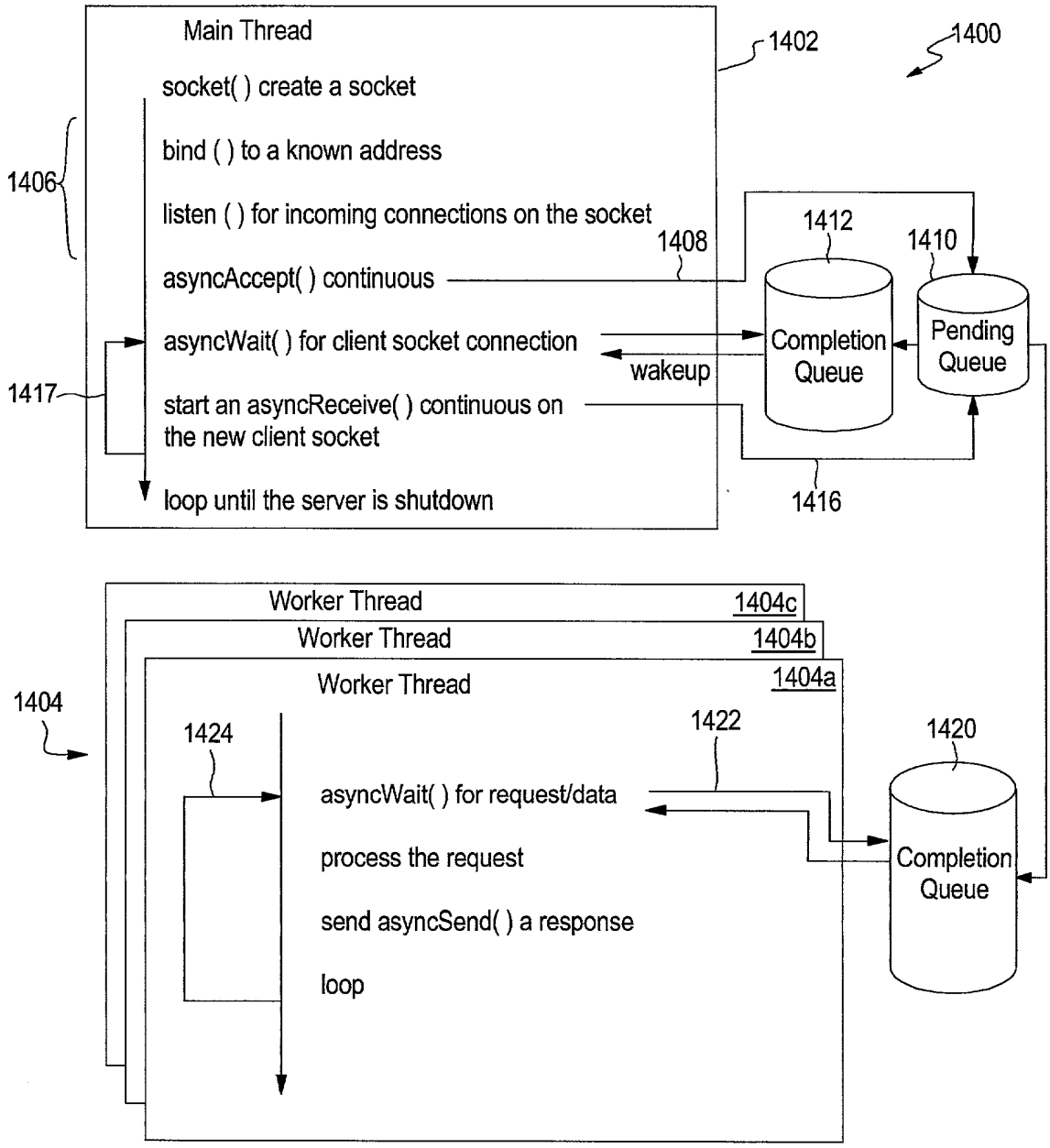
Main Thread
1402
1400
socket( ) create a socket
bind ( ) to a known address
1406
listen ( ) for incoming connections on the socket
1408
1412
1410
asyncAccept( ) continuous
asyncWait( ) for client socket connection
wakeup
Completion Queue
Pending Queue
1417
start an asyncReceive( ) continuous on the new client socket
loop until the server is shutdown
1416
Worker Thread
1404c
Worker Thread
1404b
Worker Thread
1404a
1404
1424
1422
1420
asyncWait( ) for request/data
process the request
send asyncSend( ) a response
loop
Completion Queue

FIG. 14

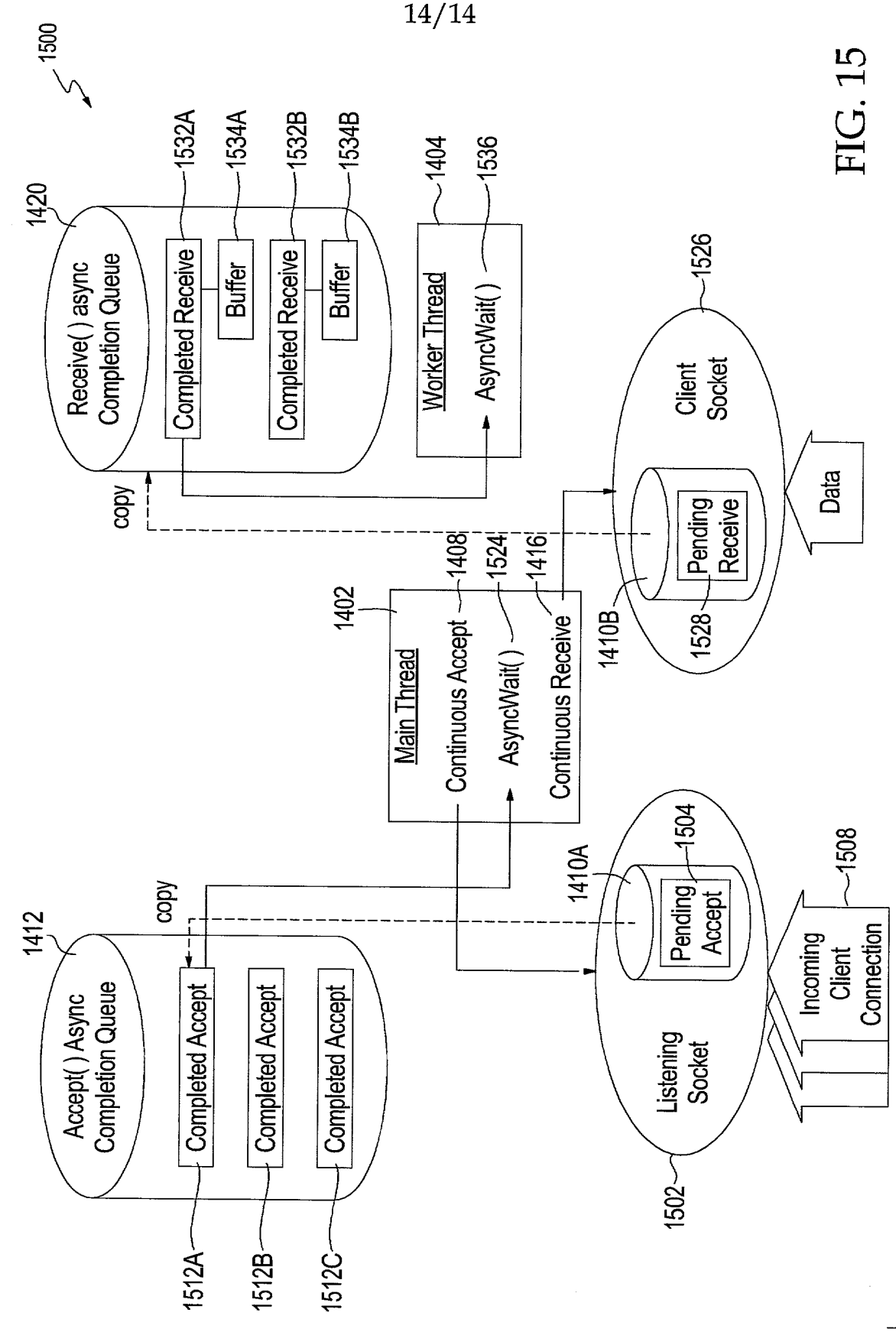
1500
1420
Receive( ) async Completion Queue
1532A
Completed Receive
1534A
Buffer
1532B
Completed Receive
1534B
Buffer
1404
Worker Thread
1536
AsyncWait( )
copy
1526
Client Socket
Pending Receive
1528
Data
1410B
1402
Main Thread
1408
Continuous Accept
1524
AsyncWait( )
1416
Continuous Receive
1412
Accept( ) Async Completion Queue
copy
Completed Accept
Completed Accept
Completed Accept
1512A
1512B
1512C
1410A
1504
Pending Accept
1508
Incoming Client Connection
Listening Socket
1502

FIG. 15